Temperature/ Process Controller
Model 900-TC16
(Series B)

English
10000022595 **(Version 00)**
Printed In China

Rockwell Automation

For detailed operating instructions, please refer to the 900-TC16 User's Manual (900-UM007_-EN-E).
It can be found online at http://www.ab.com/manuals/.

Significance of CAUTIONS

ATTENTION Indicates information that, if not heeded, could result in injury, damage to the product, or faulty operation.

RC1 9458732-2A

⚠ ATTENTION

Disconect power to device before installing or servicing.
Do not touch the terminals of controller when voltage is applied.

Do not allow metal fragments or lead wire scraps to fall inside this product. This may cause electric shock, fire or malfunction.
Do not use this product where subject to flammable or explosive gas.

This product is UL listed as open type Process Control Equipment and must be mounted in an enclosure.
More than one disconnect switch may be required to de-energize the equipment before servicing.
Signal inputs are SELV, limited energy.
Caution - To reduce risk of fire or Electrical shock, Do not interconnect the outputs of different Class 2 circuits.

Never disassemble, repair or modify the product.

The life expectancy of the output relays varies greatly with the switching capacity and other switching conditions. Always use the output relays within their rated load and electrical life expectancy. If an output relay is used beyond its life expectancy, its contacts may become fused or burned.

Use copper wire only 24-14 AWG stranded or solid. Torque screws to 0.74 to 0.90 Nm or 6.5 to 8 lb-in. Only two wires of same type and size per terminal.

To maintain safety in the event of malfunction of the temperature controller, we recommend taking safety measures, for example, installing an excessive temperature rise prevention alarm on a separate line. If malfunction prevents control, they may result in an accident.
To reduce the risk of electrical shock or fire, install in a Pollution Degree 2 environment (controlled environment relatively free of contaminants).

Set the configuration parameters of the controller and test them to ensure they are suitable for the application being controlled. If not properly configured unexpected operations may occur resulting in property damage or accidents.

If the semiconductor (Triac) output is used and an excessive electrical surge or noise spike is impressed on the output terminals, a short circuit failure of the triac output is likely to occur. This could result in excessive current draw and possible fire. Use surge suppression to prevent excessive surges and fusing to help prevent an over current condition.

When the product is used under the circumstances or environment below, ensure adherence to limitations of the ratings and functions. Also, take countermeasures for safety precautions such as fail-safe installations.

* Use under circumstances or environment which are not described in the instruction manual.
* Use for applications where death or serious property damage is possible and extensive safety precautions are required.

NOTICE

(1) Do not use this product in the following:
- •Places directly subject to heat radiated from heating equipment.
- •Places subject to splashing liquid or oil atmosphere (Exceeds NEMA 4X).
- •Places subject to direct sunlight, could discolor or cause excessive heat.
- •Places subject to dust or corrosive gas (in particular, sulfide gas and ammonia gas).
- •Places where intense temperature changes exceed the published ratings.
- •Places subject to icing and condensation.
- •Places subject to vibration and large shocks.

(2) Use/store within the rated temperature and humidity ranges.
Provide forced-cooling if required.
(3) To allow heat to escape, do not block the area around the product.
Do not block the ventilation holes on the product.
(4) Be sure to wire properly with correct polarity of terminals.
(5) Use specified size (M3.5, width 7.2 mm or less) crimped terminals for wiring.
(6) Do not wire the terminals which are not used.
(7) Allow as much space as possible between the controller and devices that generate a powerful high-frequency or surge.
Separate the high-voltage or large-current power lines from other lines, and avoid parallel or common wiring with the power lines when you are wiring to the terminals.
(8) Use this product within the rated load and power supply.
(9) Make sure that the rated voltage is attained within two seconds of turning the power ON.
(10) When executing self-tuning, turn the load and the controller ON simultaneously, or turn the load ON before you turn the controller ON.
(11) A switch or circuit breaker should be provided close to this unit.
The switch or circuit breaker should be within easy reach of the operator, and must be marked as a disconnecting means for this unit.
(12) If you remove the controller from its case, or put the controller into its case, never touch nor apply shock to the terminals and the electronic parts inside.
Make sure the electronic components and the case are not contacted when inserting the internal mechanism. Always ensure power is OFF when doing any maintenance on the controller or associated circuits.
(13) Cleaning: Do not use paint thinner or the equivalent. Use standard grade alcohol to clean the outside of the product.
(14) Consider the 2 second delay required for the controller relay outputs to respond when you design your control system.
(15) If an option unit is used in the system refer to its Installation Manual before operating.
(16) Make sure that the Digital Controller has 30 minutes or more to warm up after turning ON the power before starting actual control operations to ensure the correct temperature display.
(17) The output may turn OFF when shifting to certain levels. Take this into consideration when performing control.
(18) The number of EEPROM write operations is limited. Therefore, use RAM write mode when frequently overwriting data during communications or other operations.
Memory protection---EPROM (non-volatile memory) (Number of write operations:1,000,000)

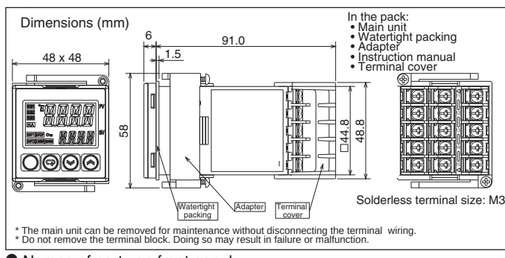
● Specifications

Power supply voltage	100-240VAC type 24V AC/DC type
Operating frequency	50-60Hz
Operating voltage range	85 to 110% of the rated voltage
Power consumption	Approx. 7.5VA (AC100-240V) Approx. 5VA (AC24V) Approx. 3W (DC24V)
Indication accuracy	Thermocouple:
(Ambient temperature: 23°C)	(±0.3 % of indication value or ±1°C, whichever is greater) ±1 digit max. Platinum resistance thermometer:
	(±0.2 % of indication value or ±0.8°C, whichever is greater) ±1 digit max.
	Analog input: ±0.2 % FS ±1 digit max.
Event input	Output current: approx. 7 mA per contact.
Contact input	ON:1 k ohm max., OFF: 100 k ohm min.
No-contact input	ON: residual voltage 1.5 V max., OFF: leakage current 0.1 mA max.
Control output 1	Relay output: SPST-NO, 250 VAC, 3A(resistive load) Voltage output: 12 VDC, 21 mA Current output: 4 to 20 mA DC and 0 to 20 mA DC, load: 600 ohms max. Electrical life of relay: 100,000 operations Triac model: 1 million operations
Control output 2	Voltage output: 12 VDC, 21 mA
Control method	↑ON/OFF or 2-PID control
Auxiliary output	SPST-NO, 250 VAC, 3 A(resistive load), electrical life: 100,000 operations
Ambient temperature	–10 to 55 C (Avoid freezing or condensation)
Ambient humidity	RH 25 to 85%
Storage temperature	–25 to 65 C (Avoid freezing or condensation)
Altitude	Max. 2,000m
Recommended fuse	T2A, 250V AC, time-lag, low-breaking capacity
Degree of protection	Front panel: Type 4X (UL50) IP66 (IEC 61010-1) Rear case: IP20, Terminal section: IP00 *The temperature controller is mounted on the flat surface of an enclosure that is rated and marked "Type 4X for Indoor Use Only"
Weight	Approx. 150g (main unit only)
Installation environment	Setup category II, pollution degree 2 (as per IEC61010-1)

■ Installation

● Dimensions

Dimensions (mm)



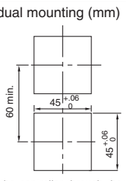
In the pack:
- Main unit
- Waterlight packing
- Adapter
- Instruction manual
- Terminal cover

Solderless terminal size: M3.5

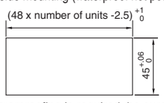
* The main unit can be removed for maintenance without disconnecting the terminal wiring.
* Do not remove the terminal block. Doing so may result in failure or malfunction.

● Mounting

Individual mounting (mm)



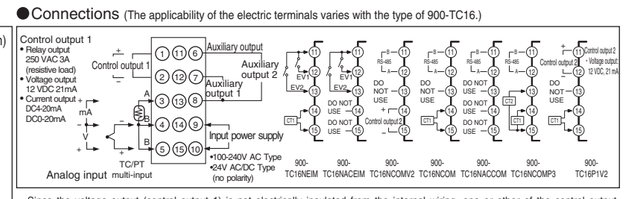
Side-by-side mounting (waterproof not possible) (mm)



When waterproofing is required, be sure to mount the controller separately.
Attach the waterproof packing from the terminal side and then insert the controller to the panel.
Recommended panel thickness is 1 to 5 mm.

- Insert the controller through the hole in the panel. Push the adapter on from the rear and fasten temporarily, removing any gap between the controller, panel and adapter. Finally, secure two mounting screws alternately keeping the torque to between 0.29 to 0.39 N•m.
- Make sure that the surrounding temperature does not exceed the allowable operating temperature given in the specifications especially when two or more controllers are mounted.

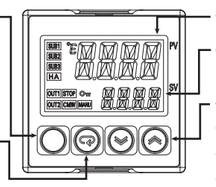
● Connections (The applicability of the electric terminals varies with the type of 900-TC16.)



· Since the voltage output (control output 1) is not electrically insulated from the internal wiring, one or other of the control output terminals must be left unearthed when using an earthed (grounding) type thermocouple. (Connection makes measurements unreliable due to ground loop currents.) Basic insulation is provided between the voltage outputs (control output 2) and internal circuits.
· Basic insulation is provided between power supply, input, output and communications (for applicable models). If double insulation is required provide supplemental insulation as defined by IEC60664.
・This is a class A product.
In residential environment areas it may cause radio interference, in which case the user may be required to take adequate measures to reduce interference.

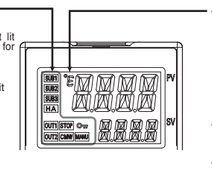
● Names of parts on front panel

- Group key
Use this key to change groups:
- Press the ◎ key and the ⇔ key together for at least 3 seconds to switch to protect group .
- Mode key
Press this key to change the contents of the display.
Press this button for 1 s or longer for reverse scroll.



- No.1 display
Process value or set data symbol
- No.2 display
Set point, set data read-out value or changed input value
- Up and Down keys
Use the keys to change the values displayed on the No.2 display.
Each press of ⩓ key increments or advances the values displayed on the No.2 display.
Each press of ⩔ key decrements or returns the values displayed on the No.2 display.

Operation indicators
- SUB1: Auxiliary output 1 indicator
Lit when the function assigned to auxiliary output 1 is ON.
- SUB2: Auxiliary output 2 indicator
Lit when the function assigned to auxiliary output 2 is ON.
- SUB3: Auxiliary output 3 indicator
Lit when the function assigned to auxiliary output 3 is ON.
- HA: Heater burnout alarm/Heater short alarm/Heater overcurrent alarm indicator
Lit when a heater burnout alarm, heater short alarm, or heater overcurrent alarm has occurred.
- OUT1: Control output 1 indicator
Lit when control output 1 is ON and not lit when it's OFF. For a current output, lit for greater than a 0% output.
- OUT2: Control output 2 indicator
Lit when control output 2 is ON and not lit when it's OFF.
- STOP: control stop indicator
Lights when event input or "Run/Stop" is stopped during operation.
During control stop, functions other than control output are valid.
- CMW: communications writing enable/disable indicator
Lights when communications writing is "enabled" and is out when it is "disabled".



- °C / °F : temperature unit
The temperature unit is displayed when the configured display value is a temperature.
When this parameter is set to "°C", "*C*" is displayed, and when set to "°F", "*F*" is displayed.
This flashes while ST(Self-Tuning) is activated.
- O/T : Protection indicator
Lit when Setting Change Protect is ON (disables the Up and Down Keys).
- MANU: Manual output indicator
Lit when the Auto/Manual Mode is set to Manual Mode.

■ Operation menu

● Input type

	Input type	Input	Setting	Setting range	
Temperature input type	Platinum resistance thermometer	Pt100	0	–200 to 850 (°C)	/ -300 to 1500 (°F)
			1	–199.9 to 500.0 (°C)	/ -199.9 to 900.0 (°F)
			2	0.0 to 100.0 (°C)	/ 0.0 to 210.0 (°F)
		JPt100	3	–199.9 to 500.0 (°C)	/ -199.9 to 900.0 (°F)
			4	0.0 to 100.0 (°C)	/ 0.0 to 210.0 (°F)
	Thermocouple	K	5	–200 to 1300 (°C)	/ -300 to 2300 (°F)
			6	–20.0 to 500.0 (°C)	/ 0.0 to 900.0 (°F)
		J	7	–100 to 850 (°C)	/ -100 to 1500 (°F)
			8	–20.0 to 400.0 (°C)	/ 0.0 to 750.0 (°F)
		T	9	–200 to 400 (°C)	/ -300 to 700 (°F)
			10	–199.9 to 400.0 (°C)	/ -199.9 to 700.0 (°F)
		E	11	–200 to 600 (°C)	/ -300 to 1100 (°F)
		L	12	–100 to 850 (°C)	/ -100 to 1500 (°F)
		U	13	–200 to 400 (°C)	/ -300 to 700 (°F)
			14	–199.9 to 400.0 (°C)	/ -199.9 to 700.0 (°F)
		N	15	–200 to 1300 (°C)	/ -300 to 2300 (°F)
		R	16	0 to 1700 (°C)	/ 0 to 3000 (°F)
		S	17	0 to 1700 (°C)	/ 0 to 3000 (°F)
		B	18	100 to 1800 (°C)	/ 300 to 3200 (°F)
	Infrared Thermosensor		19	0 to 90 (°C)	/ 0 to 190 (°F)
			20	0 to 120 (°C)	/ 0 to 240 (°F)
			21	0 to 165 (°C)	/ 0 to 320 (°F)
			22	0 to 260 (°C)	/ 0 to 500 (°F)
	Analog input	0 - 50mV	23	Use the following ranges for scaling: –1999 to 9999, –199.9 to 999.9. Vary Depending on "L", "H" value	
	Thermocouple	W	24	0 to 2300 (°C)	/ 0 to 3200 (°F)
		PLII	25	0 to 1300 (°C)	/ 0 to 2300 (°F)

• The default is "5" (shaded).
•5.ERR will be display when a platinum resistance thermometer is mistakenly connected while input type is not set for it. To clear the 5.ERR display, correct the wiring and cycle the power supply.

	Input type	Input	Setting	Setting range
Analog input type	Current input	4 - 20mA	0	Use the following ranges for scaling: –1999 to 9999, –199.9 to 999.9, –19.99 to 99.99, –1.999 to 9.999
		0 - 20mA	1	
	Voltage input	1 - 5V	2	
		0 - 5V	3	
		0 - 10V	4	

• The default is "0" (shaded).

● Alarms

Setting	Alarm type	Alarm output function: Positive alarm value (X)	Alarm output function: Negative alarm value (X)
0	No alarm function	Output off	
*1 1	Deviation upper/lower limit	ON OFF L H SP	Vary with "L", "H" values
2	Deviation upper limit	ON OFF X SP	ON OFF X SP
3	Deviation lower limit	ON OFF X SP	ON OFF X SP
*1 4	Deviation upper/lower range	ON OFF L H SP	Vary with "L", "H" values
*1 5	Deviation upper/lower limit standby sequence ON	ON OFF L H SP	Vary with "L", "H" values
6	Deviation upper limit standby sequence ON	ON OFF X SP	ON OFF X SP
7	Deviation lower limit standby sequence ON	ON OFF X SP	ON OFF X SP
8	Absolute value upper limit	ON OFF X 0	ON OFF X 0
9	Absolute value lower limit	ON OFF X 0	ON OFF X 0
10	Absolute value upper limit standby sequence ON	ON OFF X 0	ON OFF X 0
11	Absolute value lower limit standby sequence ON	ON OFF X 0	ON OFF X 0
12	LBA (only for alarm 1)		
13	PV Change Rate Alarm		

*1: Upper and lower limits can be set for parameters 1, 4 and 5 to provide for different types of alarm. These are indicated by the letter "L" and "H".
• Default = "2" (shaded)

● Error display (trouble shooting)

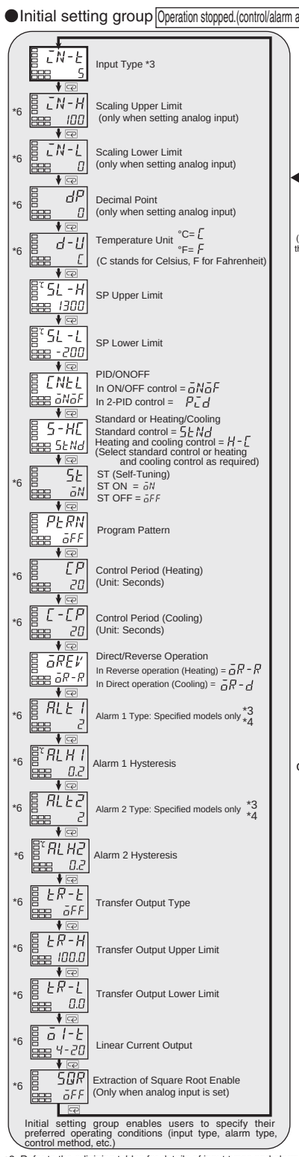
When an error has occurred, the No.1 display shows the error code. Take necessary action according to the error code, referring the table below.

No.1 display	Meaning	Action	Status at error: Control output	Status at error: Alarm
S.ERR (S. Err)	Input error *2	Check the wiring of inputs, disconnections, shorts and input type.	OFF	Operates as above the upper limit.
E333 (E333)	A/D converter error *2	After the correction of A/D converter error, turn the power OFF then back ON again. If the display remains the same, the controller must be repaired. If the display is restored to normal, then a probable cause can be external noise affecting the control system. Check for external noise.	OFF	OFF
E111 (E111)	Memory error	Turn the power OFF then back ON again. If the display remains the same, the controller must be repaired. If the display is restored to normal, then a probable cause can be external noise affecting the control system. Check for external noise.	OFF	OFF

If the input value exceeds the display limit (–1999 to 9999), though it is within the control range, [cccc] will be displayed under –1999 and [ɔɔɔɔ] above 9999. Under these conditions, control output and alarm output will operate normally.
Refer to "900-TC User's Manual" for details of control range.

*2: Error shown only for"Process value / Set point". Not shown for other status.

● Initial setting group (Operation stopped.(control/alarm are both stopped.)) *5


Input Type *3
Scaling Upper Limit (only when setting analog input)
Scaling Lower Limit (only when setting analog input)
Decimal Point (only when setting analog input)
Temperature Unit °C= C °F= F (C stands for Celsius, F for Fahrenheit)
SP Upper Limit
SP Lower Limit
PID/ONOFF In ON/OFF control = ONOF In 2-PID control = PID
Standard or Heating/Cooling Standard control = STND Heating and cooling control = H-C (Select standard control or heating and cooling control as required)
ST (Self-Tuning) ST ON = ON ST OFF = OFF
Program Pattern
Control Period (Heating) (Unit: Seconds)
Control Period (Cooling) (Unit: Seconds)
Direct/Reverse Operation In Reverse operation (Heating) = OR-R In Direct operation (Cooling) = OR-D
Alarm 1 Type: Specified models only *3 *4
Alarm 1 Hysteresis
Alarm 2 Type: Specified models only *3 *4
Alarm 2 Hysteresis
Transfer Output Type
Transfer Output Upper Limit
Transfer Output Lower Limit
Linear Current Output
Extraction of Square Root Enable (Only when analog input is set)

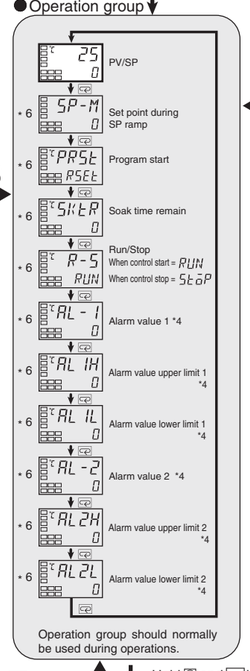
Initial setting group enables users to specify their preferred operating conditions (input type, alarm type, control method, etc.)

*3: Refer to the adjoining tables for details of input types and alarm types.
*4: Applicable only to models with alarm functions.
*5: Operation is stopped when moved to the initial setting group.
(control/alarm are both stopped.)

The setting data for the 900-TC-8 is shown here as an example.

POWER ON

● Operation group


PV/SP
Set point during SP ramp
Program start
Soak time remain
Run/Stop When control start = RUN When control stop = STOP
Alarm value 1 *4
Alarm value upper limit 1 *4
Alarm value lower limit 1 *4
Alarm value 2 *4
Alarm value upper limit 2 *4
Alarm value lower limit 2 *4

Operation group should normally be used during operations.

Hold ◎ down for at least 3 seconds (No. 1 display flushes then the control stops)

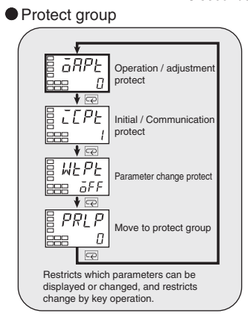
Hold ◎ down for at least 1 second

Press ◎ (less than 1 second)

Hold ◎ and ⇔ keys down for at least 1 second

Hold ◎ and ⇔ keys down for at least 3 seconds

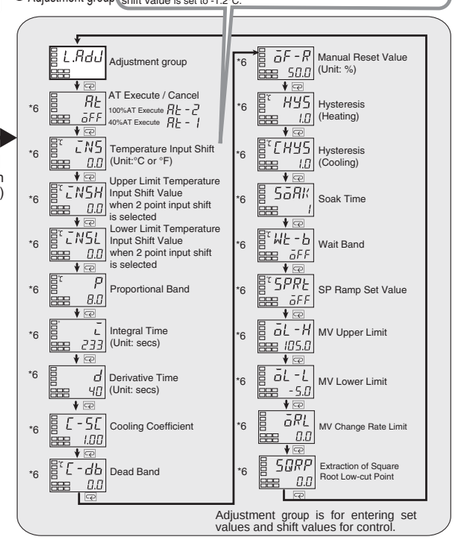
● Protect group



Restricts which parameters can be displayed or changed, and restricts change by key operation.

● Adjustment group

Only the value set to the in5 : Temperature Input Shift parameter is applied to the entire temperature input range. When the process value is 200°C, the process value is treated as 201.2°C after input shift if the input shift value is set to 1.2°C.
The process value is treated as 198.8°C after input shift if the input shift value is set to -1.2°C.


Adjustment group
AT Execute / Cancel 100%AT Execute 40%AT Execute
Temperature Input Shift (Unit:°C or °F)
Upper Limit Temperature Input Shift Value when 2 point input shift is selected
Lower Limit Temperature Input Shift Value when 2 point input shift is selected
Proportional Band
Integral Time (Unit: secs)
Derivative Time (Unit: secs)
Cooling Coefficient
Dead Band
Manual Reset Value (Unit: %)
Hysteresis (Heating)
Hysteresis (Cooling)
Soak Time
Wait Band
SP Ramp Set Value
MV Upper Limit
MV Lower Limit
MV Change Rate Limit
Extraction of Square Root Low-cut Point

Adjustment group is for entering set values and shift values for control.

*6: The grayed-out parameters may not be displayed according to the model and parameter.

● Protection function

Protection function is to prevent unwanted settings. It restricts the parameter to be used or designates if operation of the key is valid or invalid.

● Operation / Adjustment protection

The following table shows the relationship between settings and protect limits related to Operation group and Adjustment group.

Group		Set value 0	1	2	3
Operation group	Process value	○	○	○	○
	Set point	◎	◎	◎	○
	Others	◎	◎	×	×
Adjustment group		◎	×	×	×

◎ : Can be displayed and changed
○ : Can be displayed
× : Can not be displayed and change to other groups not possible
Default setting : 0 (shaded)

● Initial setting/Communications protection

This protect level restricts movement to the initial setting group, communications setting group and advanced function setting group.

Set value	Initial setting group	Communications setting group	Advanced function setting group
0	○	○	○
1	○	○	×
2	×	×	×

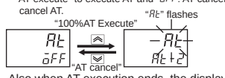
○ : Change to other groups possible
× : Change to other groups not possible
Default setting : 1 (shaded)

● Parameter change protection

Parameter changes by key operation are restricted.
OFF "OFF": Parameter can be changed by key operation
ON "ON" : Parameter cannot be changed by key operation (" O/T " will light.)
(Protect group parameters can all be changed.)

● AT (auto-tuning)

・AT in Adjustment level
Designate " AT-2 : 100% AT execute" or "AT-1: 40% AT execute" to execute AT and "OFF: AT cancel" to cancel AT.



Also when AT execution ends, the display automatically returns to "OFF" .

■ Other functions

In addition to the aforementioned, there are alarm hysteresis, automatic return of display mode and others in the advanced setting group.
Refer to "900-TC16 User's Manual" for details.
For communications details, please refer to "900-TC communications User's Manual".